INTRODUCTION TO AGRICULTURE AND AGRONOMY

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Concept of Agriculture

The word 'agriculture' has been derived from two Latin words '*ager*' means land or field and '*cultura*' means cultivation. So, literally agriculture means the **production of crops for economic purpose by cultivating soil**. Agriculture may also be defined as the **biological exploitation of soil for the purpose of production**. But in broad sense, agriculture is the branch of applied science, which deals with **production, improvement, protection, processing, marketing, extension** etc. of crops by proper utilization of natural resources. The natural resources are soil, sunlight, air, water, temperature etc.

A crop is **an organism grown or harvested for obtaining yield, which has economic value**. e.g., rice, fish, cattle, poultry, etc. So, agriculture deals not only with the economic plants but also with the animals, which have economic value.

Branches of Agriculture

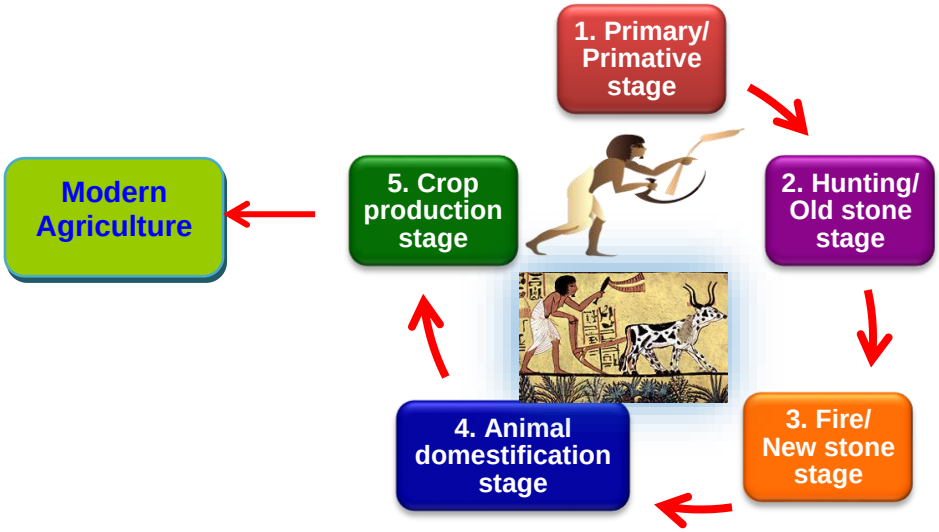
There are different branches of agriculture. The major branches of agriculture are as follows:

Crop science	•Deals with **economic plants**. e.g., rice, jute, potato etc.
Animal husbandry	•Deals with **animal production**, e.g., cattle, buffalo, goat, poultry etc.
Veterinary	•Deals with the **diseases and treatments** of animal.
Fisheries	•Deals with **pisciculture** (rearing and managing fishes).
Agricultural engineering	•Deals with **farm mechanization**.
Agricultural economics	•Deals with **economic management and marketing** of agricultural products.

Evolution of Agriculture

Excavations, legends and remote sensing tests reveal that agriculture is 10,000 years old. Women by their intrinsic insight first observed that plants come up from seeds. Men concentrated on hunting and gathering (Paleolithic and Neolithic periods) during that time. Women were the pioneers for cultivating useful plants from the wild flora.

Evolution of agriculture involves the gradual changes of agriculture from the ancient era to the civilized condition. It involves the following gradual stages:



1. ***Primary/ primitive/ root grabbing stage:*** At that stage, human being came on the earth. People were helpless and nomad and they had no houses. They were always afraid of wild animals. They used to take shelter together in the cave, earth-hole and branch of trees to escape themselves from the wild animals. They had no idea about food and crop production and used to live on natural fruits and roots.

2. ***Hunting and old stone stage****:* Before that stage, people used to face wild animals during collection of natural fruits and roots. At that stage, people had learned to save themselves from the wild animals by throwing large sized stones to those animals. They learned to make arms by breaking large sized stones for hunting. They used to eat flesh of wild animals. Gradually, women used to collect fruits and roots from near households. Thus they started to eat fruits and roots by flesh of wild animals. Women started to wear animal skin.

3. ***Fire and new stone stage:*** At that stage, people were able to make fire and prepare improved arms. They got the idea of making fire when they used to break the large sized stones into small pieces. They were able to make sharp and pointed arms by rubbing one stone with another. People learned to burn the flesh of wild animals and thus started to eat burnt flesh. Thus gradually the insecure condition of the people was changed.

4. ***Animal domestication/ husbandry stage:*** At that stage, men became expert in hunting wild animals. They used to hunt more than one animal and ate them as per requirement. Excess and gentle animals were kept for future use. Thus, animal domestication was started. Less stronger animals like cattle, goat, sheep, dog, ass etc. were domesticated first. Women and children used to take care and manage feed for those animals. Thus, animal husbandry was started first. They used to eat natural fruits and roots and did not know how to produce them. So, people used to move from one location to another for their own food and animal feed.

5. ***Crop production stage:*** After thousands of years, people wanted to settle down in a permanent site, as nomad life was unbearable. People observed that plants come up from maize seeds kept on the graveyard. Probably women by her intrinsic insight nurtured the sprouts to harvest near households. Thus, women are the pioneers of agriculture. Then people started to use fire and digging land by sticks to prepare garden plots in which they would grow small grains. They started cultivation by pointed sticks and branches of trees.

   Modern agriculture was started from 18th century.

   Green revolution was started in 1960s.

Importance of Agriculture

Agriculture is directly or indirectly contributing in many sectors of our basic needs or livelihoods which are described under following heads:

1. Food

Food is required for normal growth and energy of the body. Agriculture is the source of the following food elements-

- Carbohydrate— cereals (70-75%), potato & sweet potato (18-20%)
- Protein— meat and fish (18-20%), egg (12-13%), milk (3-3.5%), Pulses (27-28%).
- Fat— mustard and rapeseed (40-45%), soybean (20-25%), groundnut (44-46%), sunflower (42-44%), sesame (41-43%).
- Vitamins & minerals— various fruits, vegetables, milk, butter etc.

2. Clothes

Agriculture provides us fiber to make clothes. In the world, 70% of the fiber comes from cotton (*Gossypium* spp.). Other sources are jute, wool, silk, natural fiber etc., which are also obtained from agriculture.

6. Houses

People gradually felt the necessity of making houses to escape themselves from wild animals, rain, sunshine, cyclone etc. Maximum housing materials are the products of agriculture. Such as, timber, bamboo, straw, rope etc.

4. Industry

Agriculture provides raw materials in different industries. Some of the industries in which agriculture supplies raw materials are mentioned below:

a. ***Medicine industry:*** Maximum medicine industries utilize different medicinal plants like arjun, sesame etc., which are the contributions of agriculture.
b. ***Paper industry:*** Bamboo, geoa, straw etc., are used in paper industries.
c. ***Rubber industry:*** Rubber is prepared from the latex of rubber plant. It is used to prepare tier, tube and room of different vehicles and also used in different industrial products.
d. ***Soap, candle and paint industry:*** Different oils (mustard, sesame, linseed, groundnut) animal fats (goat, cattle), wax of honeybee chamber, turmeric, safflower etc. are used in this industry.
e. ***Perfume industry:*** Volatile oils extracted from different plant parts are used to prepare perfume. This perfume is used directly or to prepare perfumery, medicine and food materials.
f. ***Beverage industry:*** Tea, coffee, Coca-Cola, etc. are prepared from agricultural raw materials.
g. ***Bakery:*** Flour, egg, sugar, oil etc. agricultural products are used in preparing different bakery products like biscuits, cake etc.
h. ***Sugar industry:*** Sugarcane, sugarbeet, date palm etc. are used to prepare sugar in the sugar industry.
i. ***Narcotic and chewing industry:*** Different agricultural products are used in narcotic and chewing industry. e.g., tobacco, cocoa etc.
j. ***Leather industry:*** Hide and skin of different animals used in leather industry.

5. Fuel

Fuel of brick fields (timber, jute-stick, dry leaves etc.). Coal, petrol and gasses are obtained from plant materials. Biodiesel is one of the new ideas where diesel can be obtained from plant named *Jatropha*.

6. Earning source

People take agriculture directly or processing of agricultural products as an occupation and thus earn money. Agricultural products may be marketed in the local market or may be exported. Around 87% of the rural people are directly engaged in agriculture where most of the people are related to crop enterprises. Agriculture still employs about 45.33% of total employment of the country (BBS, 2023).

7. Foreign currency

Some agricultural products directly or in processed condition are exported and thus earned foreign currency. Such as, rice, jute, wheat, tomato, frozen fish, vegetables etc.

8. International relation

By exporting and importing of agricultural commodities a country can establish a good relation with the foreign countries. For example, Bangladesh exports tea, shrimp, jute & jute products and importing apple, grape etc. and import oils, pulses and grains as well as many fruits from abroad.

9. Revenue income

From the rent and taxes of agricultural land, agricultural products, government can earn revenue income. Agriculture contributes around 11.38% of total GDP in Bangladesh where crops plants alone contributes 5.37% (BBS 2023).

10. Natural beauty

Flower, ornamental grasses and plants bring natural beauty, which is the contribution of agriculture. Such as, roses, jasmine etc.

11. Environmental balance

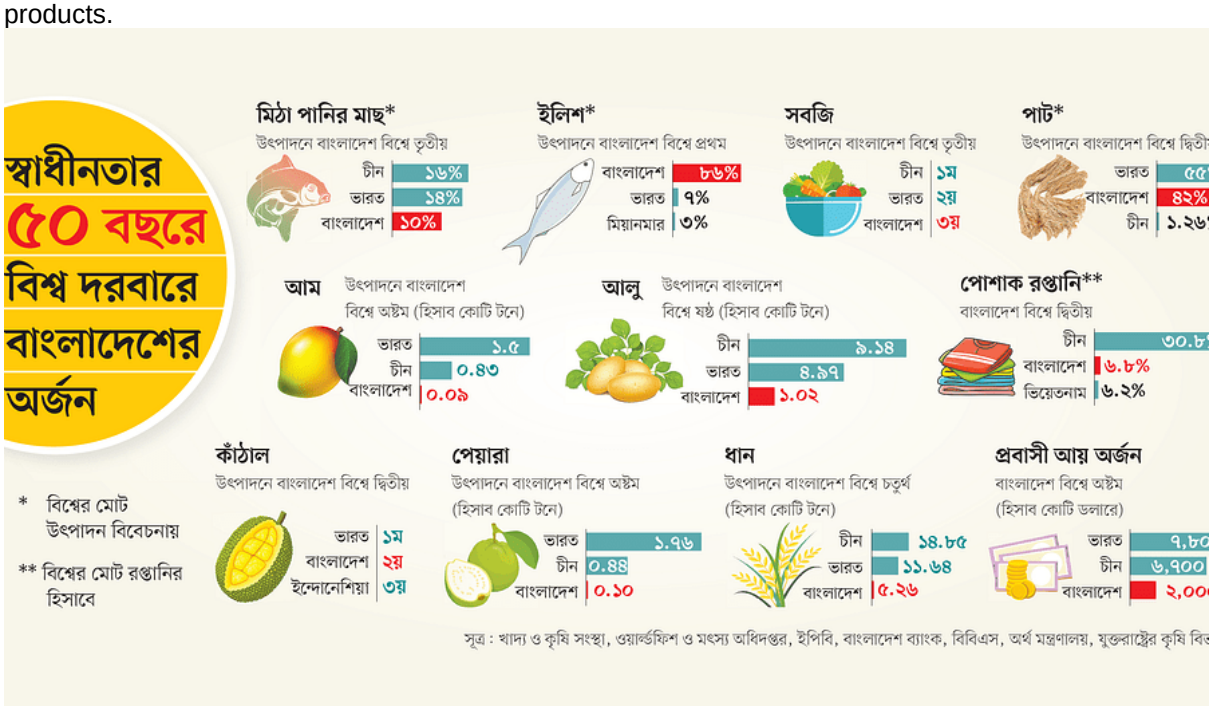
Plants liberate O_2 and animals liberate CO_2 to the atmosphere and thus the gaseous concentration of the atmosphere is balanced. Agriculture helps in environmental balance by producing plants and animals.

Bangladesh's Success in Agriculture

Bangladesh – a predominantly agricultural country – has achieved self-sufficiency in fish, meat, rice and vegetable production in the last 10 years, thanks to a set of favourable government policies.

Commercial production of fish, meat, milk and eggs witnessed a robust growth in this decade in line with growing demand. Substantial investments have also helped some of these sectors grow into big industries that are preparing to export their products after meeting local demand.

A recent report indicated that in 13 sectors Bangladesh is on top 10 among which 9 are agricultural products.



Concept and Basic Principles of Agronomy

Concept

The word agronomy has been derived from two Greek word- '*agros*' meaning field and '*nomos*' meaning to manage. So, literally agronomy means the art of managing field and technically it means the science and economics of crop production by management of farmland. In other words, agronomy may be defined as a branch of agricultural science deals with principle and practices of field management for the production of field crops.

Agronomy is the science and practice of crop production to produce food, feed, fiber, and fuel. Agronomists need to understand plants, soils, insects, microorganisms, climate and how they interact with each other within agroecosystems.

The central theme of agronomy is of soil−plant–environment relationship.

Basic principles of agronomy

A principle means a scientific law that explains natural action. Agronomic principles are the ways and means for the better management of soil, plant and environment for economically maximum returns per unit area for years.

The basic principles of agronomy may be listed as:

1. Planning, programming and executing measures for maximum utilization of land, labour, capital, sunshine, rain-water, temperature, humidity, transport and marketing facilities.

2. **Choice of crop varieties** adaptable to the particular agro-climate, land situation, soil fertility, season and method of cultivation and benefiting to the cropping system.

3. **Proper field management** by tillage, preparing field channels or bunds for irrigation and drainage, checking soil erosion, leveling and adopting other suitable land management practices.

4. Adoption of **multiple cropping and also mixed or intercropping** to ensure harvest even under adverse environmental condition.

5. **Timely application of proper and balanced nutrients** to the crop or crops in sequence and improvement of soil fertility and productivity.

6. Choice of **quality seed or seed material** and maintenance of requisite plant density per unit area with healthy and uniform seedlings.

7. **Proper water management** with respect to crop, soil and environment through conservation and utilization of soil moisture as well as by water that is available in excess. Efficient use of this water for life-saving or protective irrigation, scheduling irrigation at critical stages of crop growth and also growing crops in non-traditional seasons or belts with irrigation or rain or residual moisture.

8. Adoption of adequate, need-based, timely and exacting **plant protection measures** against weeds, insect-pests, pathogens as well as climatic hazards.

9. Adoption of suitable and exacting management practices including **intercultural operations** to get maximum benefit from dearer and difficult to get low-monetary and non-monetary inputs. Adequate input supply should be a substitute for deficiencies in management practices.

10. Adoption of **suitable method and time of harvesting** of crops to reduce field –damage and to release land for succeeding crop(s) and efficient utilization of residual moisture, plant nutrients and other management practices.

11. Adoption of suitable post-harvest technologies.

Scope of Agronomy

- Agronomy is a dynamic discipline. Because, agricultural practices are modified or new practices are developed with the advancement of knowledge and better understanding of plant and environment. For example, availability of chemical fertilizers has necessitated the generation of knowledge on the method, quantity and time of application of fertilizers. Similarly, availability of herbicides for the control of weeds has led to development of a vast knowledge about selectivity, time and method of application of herbicides.

- Gigantic irrigation projects are constructed to provide irrigation facilities. However, these projects created side effects like water logging and salinity. To overcome these problems, appropriate water management practices are developed.

- Population pressure is increasing but area under cultivation is static. More number of crops has, therefore, to be grown on the same piece of land in a year. As a result, intensive cropping has come into vogue.

- Similarly, no tillage practices have come in place of clean cultivation as a result of increase in cost of energy.

- Likewise, new technology has to be developed to overcome the effect of moisture stress under dry land conditions.

- As new varieties of crops with high yield potential become available, package of practices has to be developed to exploit their full potential.

- The factors restricting increased agricultural production are low soil fertility, crop varieties of low genetic yield potential, inadequate or non-existent control of diseases and insects, non-availability of production inputs, government economic policies affecting agriculture and weak research and extension programs.

- Restoration of soil fertility, preparation of good seed bed, use of proper seed rates, correct dates of sowing for each improved varieties, proper conservation and management of soil moisture and proper control of weeds are agronomic practices to make our finite land water resources more productive.

Thus, agronomy is a discipline of greater scope.

There are a lot of areas to be developed to gain the highest benefit by utilizing natural resources

- Adoption of site specific new crop varieties
- Using suitable and efficient agricultural implements suitable for soil and environment
- Balance fertilization and organic farming to attain sustainable agriculture
- Potential use of farm wastes, city wastes and crop residues to increase soil fertility and productivity
- Appropriate water management practices to improve water use efficiency
- New technologies to overcome stress such as salinity, drought, flood etc.
- Integrated crop management
- Finding new technologies for seed production and processing
- Development of new technologies for crop harvest and postharvest operations
- Reducing yield gap by using package and practices to explore full potential of new crop varieties
- Intensive cropping system

Classification of Agronomic Crops

According to use of crop plants and their products agronomic crops are grouped into the following classes:

a) Cereal crops: Cereal crops are the **cultivated grasses** grown for their edible starch grains. In general, the larger grains used as staple food are cereals such as rice, wheat, maize, barley etc.

> ***Millet crops:*** Millet crops are the **small grained cereals**, which are of minor importance as food, and they have a single cover. e. g., foxtail millet, proso millet, finger millet etc.

b) Oil seed crops: Crops that seeds are rich in **fatty acids**, are used to extract vegetable oil to meet various requirements are known as oil seed crops. e.g., mustard, soybean, sesame, linseed, safflower, sunflower, groundnut etc.

c) Pulse crops: These are **leguminous crops** that seeds are used as 'dal' on splitting and **rich in protein**. e.g., black gram, lentil, grass pea, cow-pea, soybean, peas etc.

d) Forage crops: It refers to vegetative matter, fresh or preserved, utilized as feed for animals such as, cowpea, maize, para grass, oats, napier grass etc.

e) Fibre crops: Crop plants grown for fibre yield. Fibre may be obtained from seed, such as cotton, stem or bark of such as jute, mesta, sunnhemp and flax; leaf such as, agave, pineapple.

f) Sugar crops: Crops grown for the production of **sugar and starch**; such as sugarcane, sugarbeet etc.

g) Green manuring crops: The crops, which are grown for incorporating plant materials in soil at green stage to enrich the soil with nutrients, are known as green manuring crops. E.g., sunnhemp, dhaincha, cowpea, green gram etc.

h) Narcotic crops: Crop plants or their products that are used for stimulating effects are known as narcotic crops. e. g., tobacco, cannabis etc.

i) Beverage crops: Crops that products are used for mild, agreeable and stimulating liquors meant for drinking such as tea, coffee, cocoa etc.

Some special purpose agronomic crops

i) Catch crops or emergency crops or contingent drops: These are crops cultivated to catch the forthcoming season. They replace a main crop that has failed due to natural hazards and utilize the remaining period of the season. They are generally of very short duration, quick growing, fast bulking, harvestable or usable at any time of their field duration and adaptable to the season, soil and cultural practices. e.g., green gram, black gram, cow pea etc.

ii) Cash crops: These crop plants are grown for sale to earn hard cash. e.g., jute, tobacco, cotton etc.

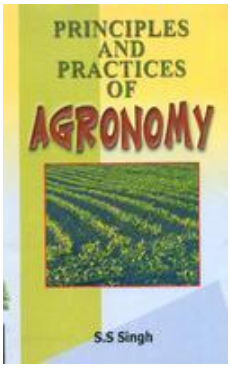
iii) Cover crops: These crop plants are able to protect the soil surface from erosion (wind, water or both) through their ground covering foliage and/ or root mats. e.g., black gram, groundnut.

iv) Mulch crops: These crop plants are grown to conserve soil moisture from bare ground by their thick and multi-layered foliage, trailing habit and sometimes, self-seeding nature. e.g., cowpea.

v) Restorative crops: These are crops, which provide a good harvest along with enrichment or restoration or amelioration of their soil, such as legumes. They fix atmospheric nitrogen in root nodules, shed their leaves during ripening and thus restore soil conditions.

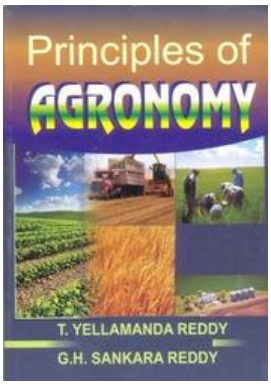
vi) Exhaustive crops: These are crop plants, which on growing leave the field exhausted because of a more aggressive nature. e.g., sesame, linseed etc.

Further Readings:

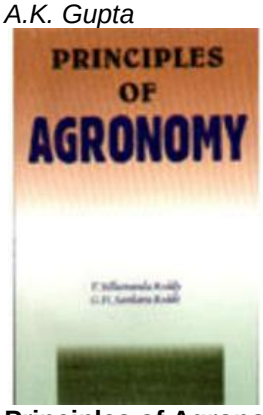


Principles & Practices of Agronomy
S.S. Singh

Handbook of Agricultural Science
S.S. Singh
P. Gupta
A.K. Gupta



Principles of Agronomy
T. Yellamanda Reddy
G.H. Sankara Reddy



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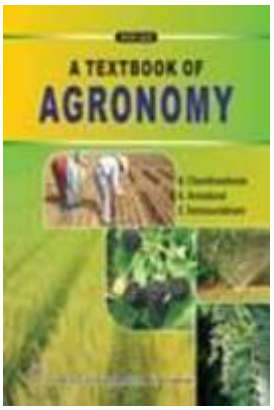
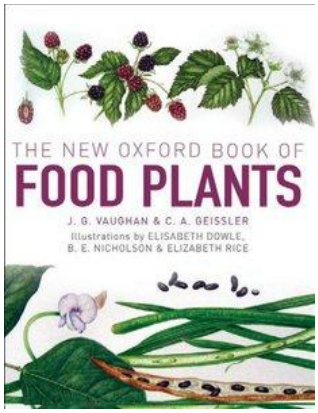


A Textbook of Agronomy
B. Chandrasekaran
K. Annaduri
E. Somasundaram



The New Oxford Book of Food Plants
J.G.Vaughan
C.A. Geissler